Abstract
Low Impact Development
A New Stormwater Management Paradigm
Micro-Scale Source Management

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What if you could develop a site or retrofit existing urban areas and…maintain or restore the predevelopment hydrological regime…dramatically reduce nonpoint pollutant loads and water quality problems…preserve the ecological / biological integrity of receiving streams and waters…effectively engage property owners in pollution prevention…reduce stormwater infrastructure construction and maintenance costs…and reduce site development and urban retrofit costs? These are the goals and the results of using the innovative low impact development (LID) stormwater management source control technology.

LID is an innovative technological approach to stormwater management and environmental protection where controls are integrated into a site to mimic predevelopment hydrology. It is not a growth management strategy nor does it heavily rely on density restrictions, clustering or conservation measures. Instead, LID focuses on how to engineer the developable portion of the site to maintain or restore environmental and hydrologic functions. LID uses new site planning / design principles and a wide array of micro-scale management practices to create a hydroloically functional and environmentally sensitive landscape. LID is a powerful technology that allows development to take place in a manner which preserves water related ecological functions / relationships and maintains development potential. LID's goal is not to mitigate development impacts but instead to recreate and preserve a watershed's hydrologic cycle and its environmental functions by engineering a site to be hydrologically functionally equivalent to the predevelopment conditions.

Today's comprehensive stormwater program is multifaceted and needs to address many objectives including runoff quantity and quality control, ecosystem / water resource restoration, combined sewer overflow reduction, protection of endangered aquatic species; surface / ground water source protection, maintaining wetland hydrology, and riparian buffer and stream protection. With over 25 years of experience with conventional use of best management practice (BMP) mitigation technology, we are beginning to realize there are significant technical, environmental and economic limitations with using BMP's in meeting these complex new watershed protection objectives. Communities with an extensive existing BMP stormwater management infrastructure are also struggling with the economic reality of funding the high costs of maintenance, inspection, enforcement and public outreach necessary to support an ever expanding and aging infrastructure. Still more challenging is the exceptionally high costs of retrofitting existing development using conventional stormwater management end-of-pipe practices to protect receiving waters.

With growing concerns about economic burdens of maintaining the stormwater infrastructure and the limitations of conventional technology to meet new watershed protection objectives, in 1990 Prince George's County' Department of Environmental Resources (PGDER) began exploring alternative stormwater management practices and strategies. The development of bioretention or "Rain Gardens" (using the green space to manage runoff within small depressed landscaped areas) lead to the understanding of how to optimize and engineer the developed landscape to maintain and/or restore hydrologic functions. In 1997 PGDER released the LID design manual demonstrating the micro-scale source control principles and practices necessary to create a hydrologically functional landscape.

LID maintains or restores the hydrologic regime and manages stormwater by fundamentally

changing conventional site design to create an environmentally and hydrologically functional landscape that mimics natural watershed hydrologic functions (volume, frequency, recharge, evaporation and discharge). This is accomplished in four ways. First, minimizing impacts to the extent practicable by reducing imperviousness, conserving natural resources and ecosystems, maintaining natural drainage courses, reducing use of pipes and minimizing clearing and grading. Secondly, recreate detention and retention storage dispersed throughout a site with the use of open swales, flatter slopes, rain gardens (bioretention), rain barrels, etc. Thirdly, maintain predevelopment time of concentration by strategically routing flows to maintain travel time. Fourthly, provide effective public education and socioeconomic incentives to ensure property owners use effective pollution prevention measures and maintain site / landscape management measures. With LID, every site feature (green space, landscaping, grading, streetscapes, roads, parking lots) is multifunctional and optimized to reduce stormwater impacts or provide / maintain beneficial hydrologic functions.

The effective use of LID site design techniques can significantly reduce the cost of providing stormwater management. Savings are achieved by eliminating the use of stormwater management ponds, reducing pipes, inlet structures, curbs and gutters, less roadway paving, less grading and clearing. Where LID techniques are applicable and depending on the type of development and site constraints, stormwater and site development design, construction and maintenance costs can be reduced by 25 % to 30% compared to conventional approaches.

The creation of LID's wide array micro-scale management principles and practices has lead to the development of new tools to retrofit existing urban development. Micro-scale management practices to recharge, filter, retain and detain runoff can be easily integrated into the existing green space and streetscapes as part of the routine maintenance and repair of urban infrastructure. LID micro-scale techniques may lead to reductions in the cost retrofitting existing urban development. Reducing urban retrofit costs will increase the ability of cities to implement effective retrofit programs to reduce the frequency and improve the quality of CSO's and improve the quality of urban runoff to protect receiving waters.

In 1998 EPA provided grant funding to assist PGDER in their efforts to develop a general manual of LID’s principles and practices and shares this technology with other local governments throughout the nation. Efforts are currently underway with EPA to further advance LID technology by improving the sensitivity of current hydrology and hydraulic analytical models for application with small watershed and sites and to develop new micro-scale control approaches and practices for urban retrofit. Additional efforts are also underway to demonstrate how LID micro-scale management and multifunctional infrastructure principles and practices can be used to control highway runoff within existing rights-of-way. It is hoped that the LID national manual will help to stimulate debate on the state of current stormwater, watershed protection and restoration technology and its future direction. Copies of the Prince George's LID design manual, the national LID guidance manual and information on bioretention can be obtained by calling Prince George's County's Department of Environmental Resources at (301) 883-5834.